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Gotta catch 'em all or not enough time: Users motivations for playing Pokémon Go™ and non-users' reasons for not installing

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Abstract

Urban exergames are played in the real-world environment using built-in mobile phone sensors. The influence of Pokémon Go on physical activity and sitting time has been examined previously, however limited research has explored motivations for using the application. Thus, the aim of this study was to explore Pokémon Go users' motivations for using the application, ex-users' reasons for abandoning the game and non-users' reasons for not installing. After institutional ethical approval, the 'Physical Activity and Pokémon Go' questionnaire was developed using Qualtrics™ and distributed using social media soon after launch

in the United Kingdom (baseline). At baseline a total of 461 participants (n=193 male, n=265 female, n=3 transgender) who were predominantly white (n=420) and did not self-report a disability (n=443) completed the questionnaire. Users' (n=236) were questioned on their motivations for using Pokémon Go and non-users' provided reasons for not installing. At 3 months a total of 127 participants (n=23 users) completed the questionnaire again and all qualitative data was thematically analyzed. The most commonly reported reason for using Pokémon Go was 'to have fun' which was 86% and 83% at baseline and 3 months respectively. The second most frequent reason at baseline was 'friends were using it' (58%) and at 3 months was 'to be outside' (48%). The least common motivation for using Pokémon Go at both baseline and 3 months was 'to meet new people' (8% and 0% respectively). At baseline, social motives and competition were two general themes which encapsulated Pokémon Go users' motivation for using the application. There were two general themes reported by Pokémon Go users' as to why they did not think they would use the application in the future. These were application related factors and factors unrelated to Pokémon Go. Non-users reported a range of reasons for not using Pokémon Go, including lack of interest and a lack of time. Safety concerns and risk of adverse events were reported by both users and non-users. This is the first study to thematically analyze motives for using Pokémon Go in which the findings are: 1) future smartphone applications aiming to increase physical activity must ensure that objectives evolve to maintain initial interest and motivation to engage with applications; 2) game developers must consider the required phone storage and capability which could be a barrier to downloading; and 3) concerns of using the application including the safety of users and those around them.

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Key words: gamification, mobile health, motivation, physical activity, Pokémon Go.

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Contributions: DRB conceived the idea for the study. DRB and SWF developed the Physical Activity and Pokémon Go questionnaire, sought ethical approval, recruited participants and undertook the data analysis. KYL and MHSL checked the data analysis. All authors wrote and approved a final version of the manuscript.

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Introduction

Despite an abundance of evidence highlighting the benefits of physical activity and the health consequences of sedentary behavior, interventions are warranted globally due to the prevalence of inactivity (Reis *et al.* 2016). For instance, 1 in 4 adults worldwide do not meet physical activity recommendations (World Health Organization, 2018) despite physical activity being reported as the fourth leading cause of mortality, accounting for 6% of deaths globally (World Health Organization, 2010). Interventions to address low levels of physical activity and reduce sedentary behavior have evolved overtime. Many are delivered through technological platforms which aim to increase physical activity through trackers or fitness applications (Middelweerd, Mollee, van der Wal, Brug, & Te Velde, 2014). Day-to-day high usage and portability of mobile phones means that this device has great potential given that they can be used to track, monitor, and alert



users about their physical activity and sedentary behavior (Higgins, 2016). The newest applications are games that incorporate real-life physical activity and participation into their game concept. For instance, urban exergames are played in an urban environment making use of built-in mobile phone sensors (Knoell, Dutz, Hardy & Goebel, 2014).

Pokémon is a media franchise managed by 'The Pokémon Company', a Japanese consortium between Nintendo, Game Freak, and Creatures. The franchise copyright is shared by all three companies, but Nintendo is the sole owner of the trademark. The franchise was created by Satoshi Tajiri in 1995 and is centered on fictional creatures called "Pokémon", in which humans, known as Pokémon Trainers, catch and train Pokémon to battle each other for sport. The English slogan for the franchise is 'Gotta Catch 'Em All'.

Pokémon Go was released globally in July 2016 as a free to play, augmented reality game. Using Global Positioning System (GPS) and the mobile phone camera, users' collect animated Pokémon characters by moving to locations throughout the real-world environment. The aim is to collect as many Pokémon characters as possible. The mobile phone vibrates to alert the user when they are near a Pokémon character. Once the user moves to the character's location, they catch it by throwing a Pokéball. These and other special items can be collected by going to a Pokéstop to battle with other users. It is important to 'level up' in Pokémon Go by earning experience points commonly known as 'XP'. The current level cap is 40 and the higher the level, the more game elements that are available to users as well as the Pokémon characters that can be caught and hatched. Users can gain XP by being physically active, travelling approximately 2-10 km and by doing so, hatch the eggs they have incubated on the application. Greater physical activity therefore increases the likelihood of collecting more Pokémon characters, particularly those that are rare.

The number of daily users dropped from 23 million in 2016 to 5 million in 2017 (Dogitev, 2017). However, Pokémon Go remains one of the most recognisable games globally. In September 2018, Niantic reported a 35% increase in usage since May 2018 due to the launch of a new trading feature (Niantic, 2018). Pokémon Go has a very large user base because it is a commercial game and it was one of the first augmented reality exergames to come to mass market. Also, the Pokémon franchise is likely to attract users which other commercial exergames might not because of consumers familiarity with it.

Previous research has reported the influence of Pokémon Go on physical activity and sedentary behavior. Howe, Suharlim, Ueda, Howe, Kawachi and Rimm (2016) examined the impact of Pokémon Go on physical activity levels, four weeks prior to installation and during the six-week period from when Pokémon go was launched. They found an increase in steps per day in 560 Pokémon Go users from pre-installation to installation, although the increase observed initially dissipated throughout the six weeks when daily steps had returned to pre-installation levels. However, Pokémon Go users daily steps was significantly greater compared to non-users for the first four weeks. Also examining the impact of Pokémon Go, Broom and Flint (2018) examined users and non-users self-reported physical activity, walking and sitting behavior at baseline and at 3-month follow up. Users reported less days of vigorous physical activity than non-users but more days of moderate physical activity and walking at baseline. In users who remained users at 3 months, sitting time increased on weekdays but moderate to vigorous physical activity and walking were maintained compared to baseline. In summary, studies have used both objective and self-report measures to assess Pokémon Go's influ-

ence on physical activity. There are different physical activity behaviors between users and non-users, favouring more active lifestyles in users but the ability for Pokémon Go to encourage users to sustain physical activity is equivocal with some studies reporting a short-term effect, whilst others have shown that physical activity levels can be maintained at 12 weeks.

Whilst the majority of research has examined the effects of Pokémon Go on physical activity and health related outcomes, less attention has been put on users' motivation to play. To the authors knowledge, Pokémon Go was not developed with a theoretical underpinning in mind and was not considered from an evaluation perspective. However, the appeal and usage indicate that aspects of motivation were tapped into by game developers and as suggested by other work in this area (*e.g.*, Rogers, 2017), Self-Determination Theory (SDT; Deci & Ryan, 1985) appears to be a pertinent theory to consider the potential impact of Pokémon Go seen in the UK and across the world. Within SDT, there are three basic psychological needs that are essential for wellbeing and psychological growth; 1) Autonomy, referring to an individual's perceived volition or control; 2) Competence, which is their perceived capability or challenge; and 3) Relatedness, referring to an individual's sense of belonging.

In Pokémon Go, an avatar provides users with a sense of autonomy through opportunities to develop and select in-game characters, and to dictate the activities that they engage in. Users also feel more competent through gaining experience points, rewards and improved status by levelling up. Opportunities to interact with other users within the game provides the platform to facilitate relatedness. Thus, Pokémon Go offers users the opportunities to experience the three basic psychological needs of SDT and in doing so, might explain the high appeal and usage globally. However, there is limited research identifying users, ex-users and non-users motivations and barriers. Moreover, where these psychological needs are thwarted, this is likely to lead to reduced motivation and engagement in outcome behaviors such as physical activity. Thus, physical activity interventions that are underpinned by SDT, consider how these innate needs are experienced and therefore met, leading to longer-term behavior change.

According to SDT, these psychological needs are more salient at certain times, and to influence or maintain motivation, culture, time and experience should be considered (*i.e.* what motivated someone is not always constant, and some people due to individual differences, these needs are stronger for some people compared to others). Ultimately, SDT suggests that these needs should be satisfied to influence motivation and subsequently behavior. Exploring whether the needs are met is therefore key and might provide greater insights into suggestions that Pokémon Go represents a fad, where high participation rates drop dramatically overtime. These insights and the potential application of psychological needs could therefore be of benefit to game designers. In accordance, Matallaoui (2017) reported in their systematic review that where exergaming has been identified as having a beneficial impact on behavioral outcomes such as reducing sedentariness and engagement in physical activity, particular consideration is needed for the design of exergaming regarding motivation and psychological outcomes is essential.

While original Pokémon fans may have downloaded the application because of their loyalty or passion for the franchise and characters, other people downloaded the application to be part of the social movement and experience. Identifying people's motivation and adherence for playing Pokémon Go is of paramount importance to ascertain how to improve the application and other health-related interventions. Marquet, Alberico, Adlakha and Hipp

(2018) examined whether motivations were correlated with perceived outcomes of playing and risks of using Pokémon Go in 47 college students (all users). The number of days Pokémon Go was played was positively associated with a set of health behaviors, including higher physical activity levels, more socialization and better mood. This however, depended on personal motivations and expectations when joining the game. Whilst their sample was limited, they distinguished 3 unique groups: 1) explicitly seeking physical activity; 2) being Pokémon fans; and 3) being curious about the phenomenon and wanting to explore opportunities to socialize.

In alignment with Marquet *et al.* (2018), Rasche, Schlomann and Mertens (2017) found that being a fan of Pokémon was the most frequent motive to start playing. Based on subjective ratings, active users were more motivated to be physically active due to playing Pokémon Go. Motivational aspects differed for active and former users since active users were more motivated by features directly related to Pokémon, such as catching all possible Pokémon characters and reaching higher levels, whereas former users stressed the importance of general game quality, such as better augmented reality and more challenges in the game. Fan status was the same for active users and former users and personality did not affect whether a person started to play Pokémon Go nor their abandonment of the game.

Both Marquet *et al.* (2018) and Rasche, Schlomann and Mertens (2017) highlighted the importance of examining the motivations for using Pokémon Go which could provide reasons for abandoning or not installing the application. Broom and Flint (2018) have previously reported the effects of Pokémon Go on physical activity and sitting time. Data was also collected on users and non-users experiences and motivations thus this manuscript presents Pokémon Go users' motivations for playing the game, ex-users reasons for abandoning the game and non-users' reasons for not installing the application. Identifying the reasons that Pokémon Go users continue to use the application, reasons for why users ceased using the application (indicating reduced motivation) and why Pokémon Go did not appeal to people requires exploration. This information could provide an insight into current use which will contribute to the design of new versions of Pokémon Go and other exergames.

Materials and Methods

Participants

A total of 461 participants ($n=193$ male, $n=265$ female, $n=3$ transgender) who were predominantly white ($n=420$) and did not self-report a disability ($n=443$), had completed the 'Physical Activity and Pokémon Go Questionnaire' (Broom and Flint, 2018). Of the 461 participants, 236 were users and 225 were non-users. Participants mean \pm standard deviation age, body mass and body mass index (BMI) at baseline was 28.96 ± 10.02 years, 73.20 ± 16.63 kg and 24.63 ± 5.08 kg.m⁻² respectively.

Two hundred and thirty-four participants provided email addresses to be contacted about future research examining Pokémon Go. These participants were followed up at 3 months with 127 participants (54.3%; $n=54$ male, $n=72$ female, $n=1$ transgender) who were predominantly white ($n=117$) and did not self-report a disability ($n=122$), completed the questionnaire for a second time. Of the 127 participants, 23 were users and the remaining 104 were non-users. Participants mean \pm standard deviation age,

body mass and BMI at 3 months were 29.67 ± 9.39 years, 72.86 ± 15.49 kg and 24.71 ± 4.66 kg.m⁻² respectively.

Measures

Participants completed the 'Physical Activity and Pokémon Go Questionnaire', further details of which can be found in Broom and Flint (2018). Of relevance to the outcomes in the current manuscript, Pokémon Go users' were asked: 'What are your motivations for using the Pokémon Go™ App?' and requested to 'tick all that apply' from the following eleven options: 1) 'To have fun' 2) 'To be outside' 3) 'To meet new people' 4) 'To experience a new challenge' 5) 'To get more exercise' 6) 'To walk more' 7) 'To improve my health' 8) 'To lose weight' 9) 'Because my friends were using it' 10) 'Because it is in the media' and 11) 'Other' and to then specify why by including text in the box provided. There were multiple opportunities to provide free text; where in separate parts of the survey: 1) users were questioned about their motivations and could provide their own motivations; and 2) users were asked to explain why they would not use Pokémon Go in the future; and 3) non-users were asked to explain why they would not use Pokémon Go in the future. The questionnaire was developed and distributed on the online platform Qualtrics™ (2018).

Procedures

Following approval from the Faculty of Health and Wellbeing research ethics committee at Sheffield Hallam University, the 'Physical Activity and Pokémon Go Questionnaire' (Broom and Flint, 2018) was distributed using social media (*i.e.* Twitter, Facebook and Pokémon Go forums) from the 22nd July 2016 onwards using a bespoke link (Pokémon Go Physical Activity Questionnaire, 2018). Participants were informed not to complete the questionnaire if they had not been able to undertake their typical amount of physical activity due to injury, illness or for any other reason during the last 7 days. After 3 months, participants who provided email addresses were contacted to complete the questionnaire again. All participants who completed the questionnaire provided consent.

Data analysis

Quantitative data was stored in Microsoft Excel and descriptive statistics are presented as frequencies and percentages unless otherwise stated. Qualitative data was inputted into Microsoft Word and thematically analyzed, as described by Braun and Clarke (2006), in five stages: 1) familiarization of the data; 2) searching for themes; 3) reviewing themes; 4) defining and naming themes; and 5) producing an outcome report. The intention for using thematic analysis was to provide a detailed description of the whole dataset, pulling out the predominant themes to describe participants' motivations and perceptions. The analysis was undertaken manually to allow for full immersion of the data. Two members of the research team (DRB and SWF) analyzed the data to identify key themes. To ensure rigor, the analysis and key themes were checked by two other members of the research team (KYL and MHSL). Smith and McGannon (2018) have highlighted problems with inter-rater reliability sometimes referred to as 'investigator triangulation'. Whilst theory free knowledge cannot be guaranteed, following discussion with all authors, themes were agreed. There were no power differentials or gender dynamics and there was minimal disagreement. As a result of the discussion, consensus was reached which is presented in the following results section.



Results

Pokémon Go users were questioned about their motivations for using the application in which the results are presented in Table 1. The most commonly reported reason at baseline was 'to have fun' which was 86% and 83% at baseline and 3 months respectively. The second most frequent reason at baseline was 'friends were using it' (58%) and at 3 months was 'to be outside' (48%). The least common motivation for using Pokémon Go at both baseline and 3 months was 'to meet new people', 8% and 0% respectively.

Results are presented in three sections as follows: 1) Pokémon Go users motivation for using the application at baseline and 3 months; 2) the reasons that Pokémon Go users did not think they would be using the application in the future; and 3) the reasons that non-users would not use the application in the future.

Pokémon Go users' motivation for using the application

Pokémon Go users offered a range of reasons for using the application. At both baseline and 3 months, the most commonly reported motivation was *to have fun* and the least was *to meet new people*. When offered the opportunity to provide other motivations for using Pokémon Go, responses included "*to catch 'em all*", "*to be a Pokémon Master*", "*childhood nostalgia*", "*makes walking more fun*" and "*to spend time with family*". At baseline and 3 months, two general themes encapsulated Pokémon Go users' motives for using the application (Figure 1).

Social Motives

Users reported a range of social motives for using Pokémon Go at baseline. First, users reported that the application has health benefits in that whilst it encourages physical activity, in particular

Table 1. Pokémon Go users motivations at baseline and 3 months.

	Have fun	Be outside	Meet new people	Experience a new challenge	Be more active	Improve health	Lose weight	Friends were using it	It's in the media	Other
Baseline (n=236)										
Frequency	204	115	19	55	71	33	24	136	51	58
Percentage	86	49	8	23	30	14	10	58	22	25
3 months (n=23)										
Frequency	19	11	0	3	5	2	2	7	1	7
Percentage	83	48	0	13	22	9	9	30	4	30

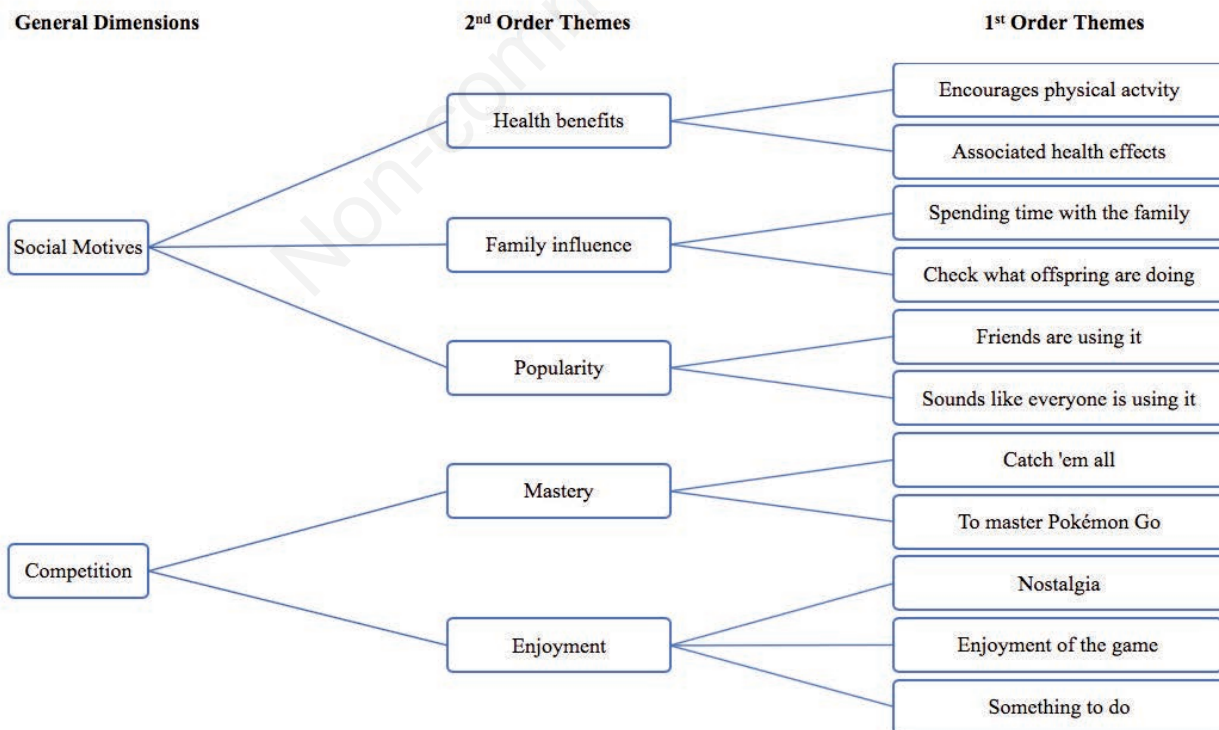


Figure 1. Pokémon Go users' motivations for using the application.

it makes walking more enjoyable. For instance, users commented that they used Pokémon Go “to make being outside walking more fun”, and “to encourage my son to walk the dogs with me”. Users also reported that family members using the application influenced them to use it (family influence). Users comments about family members influence was based on spending time with them and that parents used it to check on their children and monitor their behavior. For example, users said that they used Pokémon Go “to spend time outside with children”, “to help family members to collect Pokémon characters”, and “to find out what my children are up to.” Other motives offered by users for why they used Pokémon Go reflected the popularity of the application. Users reported that they used Pokémon Go because their friends were using it and because media and other sources suggested that many people were using the application. For instance, “colleagues are using it and talking about it”, and “lots of people have downloaded it, so I wanted to find out what it was all about”.

Competition

Motivations for using the application at baseline also reflected a desire to experience competition and that it provided an opportunity to compete with both themselves and others. Users commented that they used the application for mastery reasons, referring to the Pokémon slogan, “Gotta catch em all”, “to be a Pokémon master”, and “to catch all of the characters”. It should be acknowledged that there is an element of luck with the game in terms of Pokémon characters appearing in the user’s location. Thus, catching all the Pokémon characters may not only represent mastery, but for users, this was an important element of the game that influ-

enced their motivation. Whilst competitive, users also reported that they used the application for enjoyment. Many also reported that they used the application for nostalgic reasons, such as “I have been a fan of Pokémon since I was a child”, “it reminds me of my childhood”, and “rekindle my love of Pokémon”. Users commented that they enjoy using the application for instance, “I love playing Pokémon Go”, “I’m a massive Pokémon fan”, and “computer games are my hobby”. Finally, in some instances, users reported that they used the application to reduce boredom and fill time (something to do). For example, users said, “I use it to kill time” and that “when I am out walking, it is a convenient use of the time”.

Specifically, at 3 months, those that remained users reported maintained enjoyment (e.g., “it makes the walk into work more interesting” and “it makes walking the dogs more fun”), for something to do (e.g., “when I am out already, I put it on”), and because of family influences (e.g., “because the children want to use it”).

Reasons Pokémon Go users would not be using the application in the future

The majority of the Pokémon Go users did not think they would be using the application in the future. They offered a range of reasons for why they did not think they would be using it. The most commonly reported reasons were “lack of motivation”, “lack of interest”, and because “the application takes up too much phone storage”. Two general themes encapsulated the reasons Pokémon Go users’ did not think they would be using the application in the future (Figure 2).

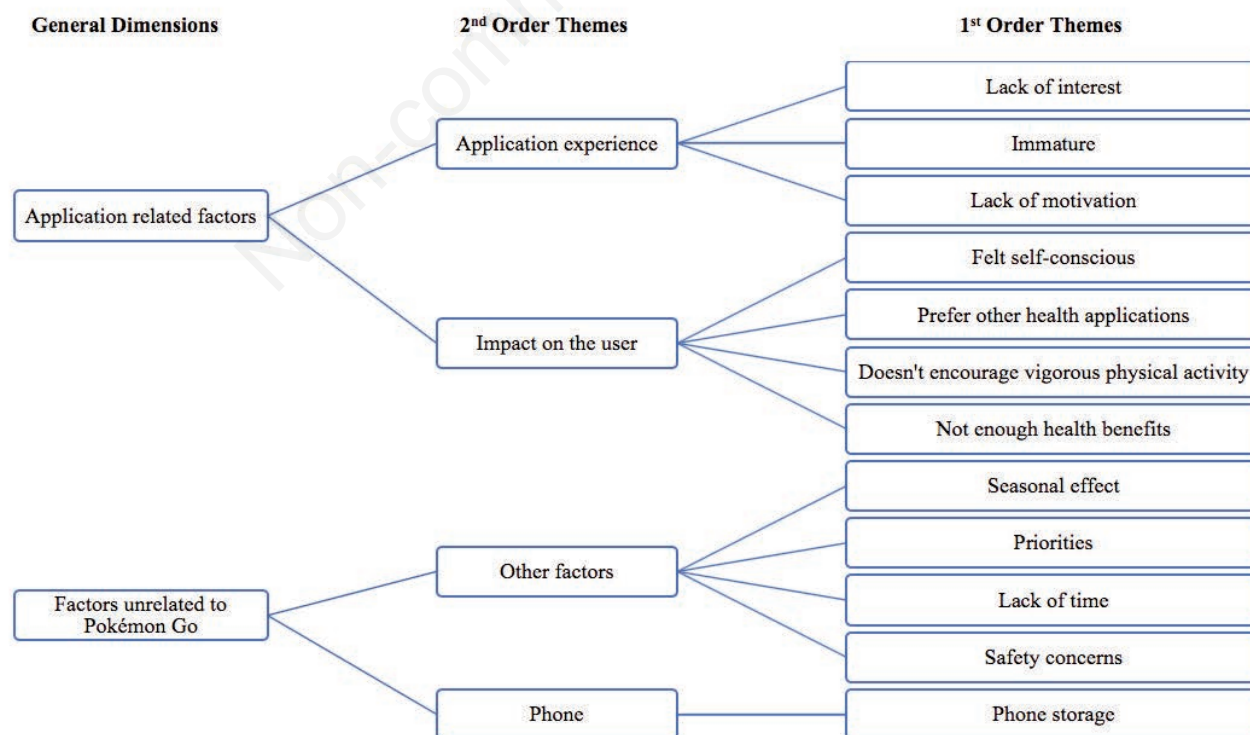


Figure 2. Reasons Pokémon Go users’ would not use the application in the future.



Application related factors

Within this general dimension, two second order themes were identified. The first was the Pokémon Go users' application experience. Users reported that they would have a *lack of interest* in using the application in the future. For instance, "I didn't find it interesting", "I think the novelty will wear off for me and I will find something more interesting", and "it's just not for me". Users also reported that they found the application *immature*, such as "I'm not 12", and "it's more for children than adults". Users also mentioned that they would have a *lack of motivation* to continue using the application in the future, commenting, and "I don't believe it has longevity as a product. The novelty will wear off", "if the app doesn't develop, it may become boring", and "I will get bored of it – partly due to game limitations – bit of a fad". The other second order theme related to the application experience was the impact on the user. One user mentioned that they would not be using the application because it made them *feel self-conscious*, commenting that "it makes me think self-conscious". Another user reported that they *prefer other health apps* saying, "I prefer to monitor my walking etc. with the health app on my phone". Other users' reported that the application did not motivate them to continue using the application as it *doesn't encourage vigorous physical activity*. For instance, "I certainly haven't sprinted to anything" and "it makes me pause to catch 'em". Last, in this second order theme, users commented that there were *not enough health benefits* for them to continue using the application in the future. For example, "I don't think it has added to my exercise regime and I feel health is more than just using an app".

Factors unrelated to Pokémon Go

There was a range of factors that were not related to the appli-

cation that users believed would reduce the likelihood of using the application in the future. The first of these was other factors which the users felt there would be a *seasonal effect*. For example, users commented that they were "unsure whether I will in the future – weather will definitely become a limiting factor during the autumn/winter" and "when the weather gets miserable it may be less fun". Users also reported that they would not be using the application because of other *priorities*. For example, "I have already deleted it as it was distracting me from everyday life" and "starting university in September". Linked to this, users reported that they had a *lack of time* to use the application commenting, "I have no time to do it and it takes too much effort" and "I don't have the time". Interestingly, participants reported that there were *safety concerns* to using the application, with one participant commenting, "going to unfamiliar places is dangerous". The other second order theme was related to users' perceptions of using their phone, with several users commenting that applications took up a lot of *phone storage* and that this was a reason they would not be using the application in the future. For instance, "take up too much space on my phone", "the app kept crashing", "my phone struggled to display it", and "uses too much data".

Reasons non-users would not use the application in the future

Non-users reported a range of reasons for not using Pokémon Go in the future. The most commonly reported reasons were "lack of interest" and "lack of time". Two general themes encapsulated the reasons Pokémon Go non-users did not think they would be using the application in the future (Figure 3).

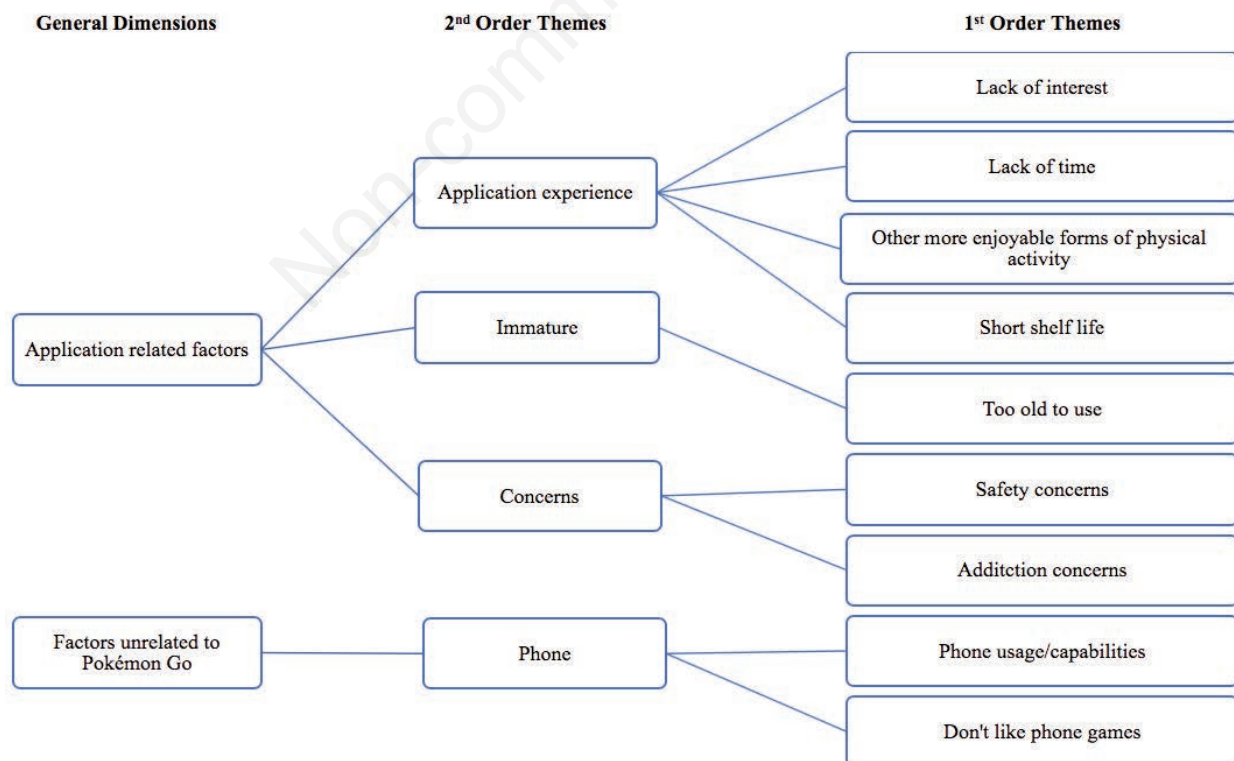


Figure 3. Reasons non-users' would not use the application in the future.

Application related factors

Within this general dimension, three second order themes were identified. The first was perceptions of the application experience. Non-users reported a perception that they had a *lack of interest* in using the application. For instance, *“no interest in the app. A lot of better things to do with time, however respect the fact that others are motivated in fitness as a by-product”*, *“not interested, I would rather spend my time more constructively training properly rather than walking around with my phone”*, and *“the concept doesn’t appeal to me, there are other things I’d rather do”*. Non-users also reported a *lack of time* to use Pokémon Go. For instance, *“I don’t have time”*, *“I have neither the time nor motivation to learn it”*, and *“no time full time sport training and work”*. Non-users viewed Pokémon Go as a physical activity game but suggested that *“there are other more enjoyable forms of physical activity”*. For example, participants commented *“I like walking in nature and would rather look at trees and birds alone than imaginary Pokémon”*, *“I live on a farm less than a mile from the north Cornwall coast. I enjoy being outside for the sake of being outside and have no interest in chasing imaginary animals around with my nose glued to my phone! I prefer real life”*, and *“It’s a fucking waste of life and I’d rather be besting myself at CrossFit”*. Finally, non-users suggested that the perceived *“short shelf life”* of Pokémon Go meant that they were not interested in using it. For instance, *“will become irrelevant and replaced by something more current and interesting”* and *“It won’t be around long”*.

Another second order theme was a perception that Pokémon Go is too immature, as they are *“too old to use it”*. They commented, *“I don’t play games with my phone. I’m an old lady!”*, *“Why would I?! It’s a child’s game”* and *“Find it sad and pathetic for anyone over 12”*. The third second order theme was about non-users concerns of using the application. Non-users said that they had *safety concerns* of using the application, for instance *“safety concerns of using it”* and *“it’s dangerous to use”*. They also suggested that they had *addiction concerns* such as *“because if I play it, I will become addicted to it”* and *“because I’m afraid to become addicted to Pokémon Go”*.

Factors unrelated to Pokémon Go

Whilst limited, non-users did report factors that were not related to the application as to why they would not use Pokémon Go in the future. These were phone related reasons. Non-users said that *phone usage/capabilities* were a reason that they would not use the application. For instance, *“it drains battery and data”*, *“my phone doesn’t download Pokémon go app”*, and *“current phone is too old to download it”*. They also reported that they *do not like phone games* commenting, *“I do not like playing phone games”*, *“I don’t do online games or apps”* and *“don’t really do games apps”*.

Discussion

The aim of this study was to explore Pokémon Go users’ motivations for using the application, ex-users’ reasons for abandoning the game and non-users reasons for not installing the application. The key finding of this manuscript is there are a range of motivations for users playing Pokémon Go, but the most prominent are enjoyment and the competition associated with catching all Pokémon characters as well as the competition with others. These findings are linked to SDT’s (Deci & Ryan, 1985) basic needs of competence and relatedness. However, the competence related reasons reported, linked to the Pokémon slogan, *“gotta catch ‘em all”*

which was directly quoted, frequently. However, this proved to be a limiting factor in motivating users who highlighted that they would no longer use the application once they had collected all Pokémon characters.

This makes sense given that the basic needs of SDT (Deci & Ryan, 1985) are unlikely to be satisfied and motivation to continue using the application is likely to be low, as the application does not evolve. The challenge of the application is lost when the objective has been completed and it is therefore likely that the lack of evolution and adaptation means that these needs are met in various ways (*i.e.* user experiences consistent throughout). Thus, the basic needs of SDT are experienced the same with little variation to reflect individual differences, time, experience and culture which are key considerations that can thwart motivation and ultimately associated behavior. This is likely to reflect the assumed lack of theoretical underpinning when designing Pokémon Go which is unlikely to have considered the psychological needs that SDT suggests are pertinent to motivation. Given the engagement and mass popularity in Pokémon Go when it was first launched and immediately after, the psychological needs are likely to have been met, but became thwarted, reducing motivation and overall use. The findings of the current study provide some insights that explain why as for some users their motivation clearly reduced over a 3-month period and they became ex-users. However, timely evolution and consideration of meeting the psychological needs of SDT, Pokémon Go might lead to long-term adherence and continued motivation, and the games developers should focus on this to keep people engaged.

The key finding as to why non-users have not installed Pokémon Go or users highlighted that they would not be using the application in the future was due to *“not enough time”*. This is unsurprising given that a lack of time is the most commonly reported barrier to meeting physical activity guidelines in the UK (Knox, Musson and Adams, 2015) and globally (Bauman *et al.* 2012). Few participants reported that Pokémon Go could not be installed because they didn’t have a smartphone, which is to be expected given the high volume of people in the UK who report owning a smartphone (Ofcom, 2017). However, mobile phone capabilities and storage were reported as factors that influenced the use of Pokémon Go. Whilst predominantly mentioned by ex-users and non-users they were also a barrier for users to using Pokémon Go in the long-term. Whilst it could be argued that other features or applications could be deleted, issues relating to data storage were evident and therefore game developers should consider a careful trade-off between user experience that does not demand too much of the phone’s capacity.

Interestingly both users and non-users reported safety concerns in using the application as finding Pokémon characters would often mean that users would go to unfamiliar places which could potentially be dangerous. Safety concerns have been raised previously by Barbero, Carpenter, Maier and Tseng (2018) with 34% of their sample experiencing an adverse event. There were 8 instances of severe injuries including fractures or head trauma, but the majority were musculoskeletal or skin injuries. This information is important and should be considered by Pokémon Go and other designers of augmented reality games because of the potential risks of using the application. Despite increasing physical activity, reducing sedentary time and improving health (Broom & Flint, 2018), using Pokémon Go could also lead to adverse events such as road traffic accidents and collisions due to not paying attention which was reported as a reason for reduced motivation to using the application in the future. This is potentially because of increased media attention focusing on these issues so that users are becoming



more aware of the potential risks.

Suggestions have been made for augmented game developers to put restrictions on using the application when travelling at speeds that indicate a person is driving which would prevent automobile collisions (Ayers, Leas, Dredze *et al.*, 2016). However, as with all population-based interventions, consideration of adverse risk must be considered and it is a responsibility of game developers to address such concerns in future iterations. Whilst there is no such thing as no risk, regardless, the benefits of an active lifestyle which can be accrued through Pokémon Go far outweigh any risks and the number of aforementioned adverse events is extremely small considering the number of users globally which is in the millions.

Another reason that both users and non-users reported that they would not be using the application in the future was that they perceived the application as more relevant for a younger audience. Pokémon Go is predominantly viewed as something that children and young people would be interested in despite this for some having nostalgic effects. Whilst this initially had a positive effect in terms of reminding users of child experiences and previous interest in the animated game, in 1995 when the franchise was launched those who were 6-10-years-old at that time would now be 29 - 33 years. Longer-term, motivation to use Pokémon Go was not evident. However, this study did not sample children, so any differences cannot be ascertained and long-term motivation might have been observed in a younger sample.

In comparison to Marquet *et al.* (2017), they identified clusters which differed significantly based on the enjoyment of certain aspects of the game, particularly battling, discovering new places, and meeting new people, as well as differences in agreement that playing improved mood and made them more social. These findings are similar to the present study as there were clear social motives as well as playing for enjoyment and to meet new people. All groups perceived traffic as a major threat to playing which is similar to the safety concerns raised by a number of participants in the present study. Marquet *et al.* (2017) also reported that days when playing Pokémon Go were associated with higher number of steps reported at the end of the day, especially among physical activity seekers which is in agreement with the physical activity behaviors reported in our previous study (Broom & Flint, 2018).

Rasche *et al.* (2017) highlighted that motivational aspects differed for active and former users, whereas fan status was the same within both groups. This is supported by the findings of the present study as many users stated they were fans of the franchise and had familiarity with it. We have also confirmed that users are more motivated by the feature directly related to Pokémon Go which is catching all possible characters and reaching higher levels. Interestingly, Rasche *et al.*'s. (2017) finding that personality did not affect whether a person started to play Pokémon Go nor their abandonment of the game cannot be confirmed or refuted in the present study but the recording of personality traits would be pertinent in future enquiry.

The strengths of the study are that to the authors' knowledge this is the first examination of Pokémon Go to question users, ex-users and non-users about their motivations and barriers for using and not using the application through open-ended questioning. However, this study is not without limitations. Ethical constraints prevented recruitment of children and young people who are likely to be the most prevalent users of Pokémon Go. Whilst participants were able to provide their perceptions in the free text box provided, they may not have responded to all questions due to time constraints or boredom. The presence of an investigator may have encouraged greater responses but other methods such as semi-structured inter-

views or focus groups were not possible due to resourcing issues. These methods would have allowed the investigators to probe and request more detail or clarification on the responses provided. Finally, the number of participants who completed the questionnaire who were users at both baseline and 3 months was small. Therefore, the percentages reported as descriptive data presented in this group need to be interpreted with caution.

Future research for physical activity researchers

When conceiving the study, the original intention was to explore potential changes in motivation of users at baseline compared to 3 months. However, based on the small sample size of Pokémon Go users who remained users at 3 months, the authors decided that inferential statistical analysis of data would be insufficiently powered. This should however be a focus of future research to understand changes in motivation when using Pokémon Go as a physical activity intervention on a much larger scale and to a global audience as participants were predominantly from the UK.

Pokémon Go continues to be an interesting case study because it is commercially designed as entertainment without any specific public health intentions. Studying it is useful because it can give insights to game developers and physical activity researchers about how to design games which are intended to promote physical activity. It is unlikely that any physical activity game designed by public health officials or researchers would gain the same popularity, so it offers insights at scale which would typically not be available. Large organizations have a corporate social responsibility to promote healthy behavior and it would be pertinent to question the game developers specifically about their own motivations for developing Pokémon Go that are not merely financial. Pokémon Go's developers are encouraged to work with physical activity researchers to identify the mechanisms of behavior change where Pokémon Go has been shown to increase physical activity. This would provide essential information for the critical design of effective digital / e-health related physical activity interventions in the future. Future research should use semi-structured interviews to get richer data and in particular explore how to prevent users from abandoning applications.

Given that both users and non-users in the current study suggest that Pokémon Go is more age-related to younger generations. Future research should explore motivations for using the application in this population. The effectiveness of exergames in children is equivocal, in particular Robertson *et al.* (2017) report that there were no significant differences in step count, moderate or vigorous intensity physical activity or self-efficacy. An intervention group of children using 'FitQuest' (a smartphone game for the Android platform) was used in primary school physical education (PE) lessons compared to a control group undertaking standard mandated PE lessons. None of the children spent the recommended time per week playing 'FitQuest' and the authors comment that the disappointing results could be due to flaws during the design and evaluation process. They present proposals for improving the research process for developing serious games for children which games targeting adults could learn from. Briefly, Robertson *et al.* (2017) state these include deepening the ways in which we interact with domain expert colleagues, developing a shared understanding of the expectations for different phases of the evaluation, and closing the gap between game design knowledge and domain theories. Also, developing guidelines for monitoring intervention fidelity which should be applied to research examining applications in adults.

Practical application for game designers

The key findings of this study are particularly useful for game designers as it is clear that a franchise and the associated nostalgia can lead to mass popularity initially. Users are motivated by the application's competitive elements, clear in this study by the direct reference to the Pokémon slogan. To prevent users from becoming ex-users, game designers must think of innovative ways for augmented reality games to evolve which could include the inclusion of new characters to find as well as new challenges. The findings should be considered for future development or redesigning of mobile phone applications that aim to engage people in physical activity. Game designers should consider how these types of interventions might influence longer-term motivation and thus, physical activity which can have a benefit on population health, given the number of people who have downloaded Pokémon Go. The findings provide insights into the motivations and barriers for using mobile phone applications that encourage physical activity and in doing so, reduce sitting time.

Conclusions

This study informs why Pokémon Go users are motivated to use the application and non-users are not. This study offers novel information that suggests: 1) future smartphone applications aiming to increase physical activity ensure that the objectives evolve to maintain initial interest and motivation to engage with an application; 2) consider the required phone storage and capability as this might present a barrier to continued use or for some an inability to download the application in the first instance; and 3) consider potential concerns of using the application including the safety of users and those around them. To the authors' knowledge, this is the first study to thematically analyze motives and barriers for using Pokémon Go in which the findings are critical in understanding potential physical activity efforts, but also informing the design of future augmented reality games.

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